



CANDIDATE INSTRUMENT LIST PRIORITIZATION

LUVOIR STDT Meeting 2

Greenbelt, MD

Aug 19, 2016

Principles for the instrument list

- ⦿ This is a first draft than can be modified as we learn more
- ⦿ We're doing this now because we need to get serious about science / engineering trades
- ⦿ Don't get overly concerned about specifying details right now

Principles for the vote

- ⦿ Each voting STDT member gets 5 chips
- ⦿ Some remote participants have emailed their choices and/or designated a proxy
- ⦿ Each voter can put down more than one chip on a candidate instrument, but must put down chips on at least two instruments

What instruments are we voting on?

◎ UV imager & spectrograph

- Key science: host star characterization, Lyman continuum luminosity function over time, imaging CGM, planet formation, high energy physics in Solar System & exoplanets, IGM in absorption, dust everywhere, characterizing sources of reionization
- > 1 arcmin imager (no coronagraph)
- High resolution spectroscopy ($R = 1000 - 200,000$)
- Multi-object spectroscopy (look into an IFS)

Questions for UV instrument

- ⦿ FOV for UV imager
- ⦿ Exact total bandpasses for imager and spectrograph
- ⦿ Exact simultaneous bandpasses
- ⦿ Spectral resolution range, how many values of R ? 3?
- ⦿ Define multi-object capability. How many at once, FOV? Something angular resolution?
- ⦿ Look at adding IFS

What instruments are we voting on?

⦿ Optical / NIR coronagraph

- Key science: biosignatures for exoEarths around sun-like stars, habitable exoplanet discovery & characterization, exoplanetology, AGN & their hosts, terrestrial & giant planet formation, exoplanet evolution, substellar objects, exomoons / rings, biosignatures for exoEarths around some low-mass stars (check this), extreme mass ratio binary stars
- Imaging w/ polarimetry
- Low resolution ($R \sim 200$), spatially resolved spectroscopy
- As big a bandpass as we can

Questions for coronagraph

- ⦿ Exact total bandpass
- ⦿ Simultaneous bandpasses
- ⦿ Spectral resolution
- ⦿ IWA / OWA
- ⦿ Contrast floor & contrast
- ⦿ Define polarization capabilities

What instruments are we voting on?

◎ Wide-field optical / NIR imager

- Key science: transcendentally deep fields (aka. galaxy evolution), KBO discovery, exoplanet masses, dark matter, Solar System comet atmospheres, lensing at all scales, gravity wave source localization (look into this one), galactic structure, characterizing sources of reionization, stellar populations / IMF, fast moving Solar System objects, SN and progenitors, low surface brightness diffuse tidal streams (needs great flat fielding)
- 4 – 6 arcmin FOV
- Colors maybe a grism (simultaneous colors or not?)
- Sub-microarcsec astrometry

Questions for wide-field imager

- ⦿ Exact FOV
- ⦿ What exact total bandpass? How blue?
- ⦿ Exact simultaneous bandpasses (filters)
- ⦿ Diffraction limited at 0.5 micron?
- ⦿ Scheme for astrometry calibration

What instruments are we voting on?

◎ Multi-resolution optical / NIR spectrograph

- Key science: exoplanet transit spectroscopy, low metallicity stars, planet masses, planet formation chemistry, biosignatures w/ transits & template matching, high-redshift galaxies, deep molecular probes of Solar System bodies, dynamics of planetary atmospheres (SS and exo), characterization of stars in the local group
- Point source (consider additional IFU mode)
- $R \sim 100,000$ for template matching, solar system
- $R \sim 2000$ for transit spectroscopy, solar system
- High precision ~ 1 cm/s RV capability and $R > 100,000$ (needs study)

Questions for opt/NIR spectrograph

- ⦿ Broad wavelength coverage in single obs, as red as we can go
- ⦿ Exact spectral resolutions?
- ⦿ Shall we have an IFU? Can we beat the ground here?
- ⦿ Scheme for high precision RV calibration
- ⦿ How compelling is the RV case? Better considered as second-generation?
- ⦿ More detailed science case for template matching. Feasibility? Need coronagraph?

What instruments are we voting on?

- ◎ Multi-object optical / NIR spectrograph
 - Key science: stellar populations, star formation in galaxies at 100 pc scales, galaxy outflows and feedback, first galaxy clusters, emergence of large scale structure, extragalactic SNe, fine structure constant, IMF, fundamental constants
 - 2 – 6 arcmin FOV
 - Does it hold up against ELTs?

Second generation instruments?

- ◎ Follow-on starshade !
 - Key science: really good NUV / NIR high contrast exoplanet spectroscopy for biosignatures
 - Have an eye to keeping the facility “starshade ready”
 - With upgraded spectrograph to go with it
- ◎ Black box that gets planet masses one way or another, if necessary
- ◎ Upgrades to all instruments (e.g. more advanced coronagraph)

Second generation instruments?

- ⊙ Kilohertz-speed UV / optical photometer
 - What's it for? Asteroseismology? Occultations of solar system bodies?
 - Should we add this to the coronagraph?
 - David Redding & Marc Postman to write the science cases for this capability
- ⊙ Super-high resolution NIR spectrograph
 - Heterodyne?
 - Like $R > 1,000,000$

Second generation instruments?

- Super-resolution imager

More questions

- ⦿ Instrument leads & teams
- ⦿ Flag observation concepts that drive telescope operations requirements (e.g. time resolved obs).
- ⦿ Prepare for architecture decisions in Nov
 - Driving science cases
 - Feasibility considerations
 - Other things?
- ⦿ Field of regard?